

The attached Appendix includes marked-up copies of each rewritten claim (37 C.F.R. §1.121(c)(1)(ii)).

In view of the foregoing amendments and the following remarks, reconsideration of the application is respectfully requested.

I. Rejection Under 35 U.S.C. §102(e)

Claims 1 and 7-9 were rejected under 35 U.S.C. §102(e) as allegedly being anticipated by U.S. Patent No. 6,064,258 (hereinafter Shulman). This rejection is respectfully traversed.

Shulman fails to teach or suggest a differential amplifier that includes a first differential amplifier circuit having a first differential pair and a second differential amplifier circuit having a second differential pair in which at least one of the first differential pair and the second differential pair is formed from a pair of transistors having a driving ability difference therebetween, as well as including a third transistor of the primary conductive type which operates based on a first signal from the first differential amplifier and a third transistor of the secondary conductive type connected in series to the third transistor of the primary conductive type and operating based on a second signal from the second differential amplifier circuit as recited in claim 1. That is, as acknowledge in the Office Action at the top of page 3, Shulman fails to teach or suggest the push-pull configuration previously recited in claim 2 and now recited in claim 1.

Still further, Shulman also fails to teach or suggest a differential amplifier circuit in which the first differential amplifier circuit outputs the first signal in order to output a first output voltage lower than the common input voltage through the third transistor of the primary conductive type, and the second differential amplifier circuit outputs the second signal in order to output a first output voltage higher than the common input voltage through the third transistor of the secondary conductive type.

In view of the deficiencies in the teachings of Shulman, Applicant respectfully submits that Shulman cannot be seen to anticipate present claim 1 or claims 7-9 dependent therefrom.

For at least the foregoing reasons, Applicant respectfully submits that Shulman fails to anticipate the invention of claims 1 and 7-9. Reconsideration and withdrawal of the rejection under 35 U.S.C. §102(e) are respectfully requested.

II. Rejection Under 35 U.S.C. §103(a)

Claims 2-6 were rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Shulman in view of U.S. Patent No. 6,005,439 (hereinafter Fong). This rejection is respectfully traversed.

As discussed above and as acknowledged in the Office Action, Shulman fails to teach or suggest the push-pull configuration in the differential amplifier circuit of claim 1. The Patent Office turned to Fong as allegedly suggesting inclusion of such configuration in the differential amplifier of Shulman. Applicant respectfully disagrees with the conclusion of the Patent Office, and asserts that one of ordinary skill in the art would not have been led to the present invention of claim 1 from the combined teachings of Shulman and Fong.

Fong does not remedy the deficiencies of Shulman, and would not have led one of ordinary skill in the art to the invention of claim 1. Fong describes a unity gain signal amplifier. For example, as shown in Figure 7 in Fong, such amplifier circuit 50 includes an upper circuit 52 and lower circuit 54 that provides increased voltage pull-down and output current sinking capacity for the output 113. See col. 4, lines 36-42. The upper circuit 52 includes a current mirror circuit comprised of three transistors 16a, 18a and 22a that provide three related currents 17, 19 and 23 to the differential amplifier transistors 12 and 14. Similarly, the lower circuit 54 comprises a current mirror circuit formed by three transistors

116a, 118a and 122a that provide current to two transistors 112 and 114. Transistors 12 and 14 and transistors 112 and 114 are described to be matched transistors in Fong.

While Fong does describe a push-pull configuration as noted in the Office Action, Fong does not teach or suggest a differential amplifier having a current mismatch between a differential pair. Fong instead describes a differential amplifier circuit that includes current mirror circuits and matched transistors. It would thus be impossible for the configuration of Fong, if incorporated into the configuration of Shulman as alleged in the Office Action, to perform the features incorporated into claim 1 concerning the operation of the differential amplifier based on a current mismatch between a differential pair.

Further, as described at page 14, line 26 to page 15, line 3 of the specification, it is possible with the differential amplifier of claim 1 to output the same voltage as the output voltage V_{OUT} of the differential amplifier shown in Fig. 7 without having to offset input voltages while simultaneously enabling accomplishment of low power consumption. Neither Shulman nor Fong teach or suggest the advantages achieved by the differential amplifier of claim 1, and thus would not have led one to the embodiment of claim 1.

Thus, Shulman at best describes an amplifier circuit that includes a pair formed from a pair of transistors having a current mismatch but lacking a push-pull configuration, and Fong at best describes a unity gain amplifier that has a push-pull configuration but includes matched transistors. Neither Shulman nor Fong teach or suggest a differential amplifier that includes both a push-pull configuration and a current mismatch between a differential pair as in the differential amplifier of claim 1. Neither Shulman nor Fong teach or suggest how the references could have been combined to integrate the different aspects of these two different amplifiers together as in the invention of claim 1.

The Patent Office merely theorized that it would have been obvious to have extracted a push-pull configuration such as illustrated in Fong and added such into the amplifier of

Shulman. Applicant respectfully disagrees for several reasons. First, it is not at all evident that one of ordinary skill in the art would merely have extracted the push-pull configuration described in Fong to include in Shulman. Neither Shulman nor Fong teach or suggest any reasons to do so. In particular, neither Shulman nor Fong provide any indication that the push-pull configuration of the amplifier circuit described in Fong would be necessary and/or advantageous in the amplifier circuit of Shulman.

Second, and related to the first above, the Patent Office theorized that one of ordinary skill in the art would have found motivation from a desire to increase the output current driving capability and output voltage pull-up of the Shulman amplifier as allegedly suggested by Fong. However, while Fong does describe an amplifier circuit that is described to yield increased output current driving capability and output voltage pull-up, such is particular to the overall design of Figure 7 in Fong, and is not attributable solely to inclusion of a push-pull configuration therein. Accordingly, the theory of the Patent Office would at best have led one of ordinary skill in the art to have completely replaced the amplifier of Shulman with the amplifier of Fong in order to derive the desired result, and would not have led one of ordinary skill in the art to extract only a push-pull configuration from the amplifier of Fong and include such in the different amplifier design of Shulman.

Finally, Applicant respectfully submits that because Shulman describes an amplifier in which the amplifiers are to have transistors with a current mismatch therein, one of ordinary skill in the art would have been led away from including in Shulman the configuration of Fong having matched transistors.

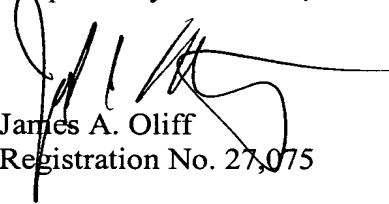
For at least the foregoing reasons, Applicant respectfully submits that Shulman and Fong, whether considered singly or in combination, fail to teach or suggest the presently claimed invention. Reconsideration and withdrawal of this rejection are respectfully requested.

III. Conclusion

In view of the foregoing amendments and remarks, Applicant submits that claims 1-9 are in condition for allowance.

Should the Examiner believe that anything further is necessary in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



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Attachment:
Appendix

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<p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 15-0461</p>
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APPENDIX

Changes to Claims:

The following are marked-up versions of the amended claims:

1. (Amended) A differential amplifier comprising:

a first differential amplifier circuit having a first differential pair and operating based on a common input voltage; and

a second differential amplifier circuit having a second differential pair and operating based on the common input voltage;

a third transistor of the primary conductive type which operates based on a first signal from the first differential amplifier; and

a third transistor of the secondary conductive type connected in series to the third transistor of the primary conductive type and operating based on a second signal from the second differential amplifier circuit.

wherein at least one of the first differential pair and the second differential pair is formed from a pair of transistors having a driving ability difference therebetween,

wherein the first differential amplifier circuit outputs the first signal in order to output a first output voltage lower than the common input voltage through the third transistor of the primary conductive type.

and wherein the second differential amplifier circuit outputs the second signal in order to output a first output voltage higher than the common input voltage through the third transistor of the secondary conductive type.

2. (Amended) The differential amplifier as defined in claim 1, further comprising:

a first current mirror circuit provided in the first differential amplifier circuit and formed from a first transistor of a primary conductive type and a second transistor of the primary conductive type; and

a second current mirror circuit provided in the second differential amplifier circuit and formed from a first transistor of a secondary conductive type and a second transistor of the secondary conductive type;

~~—— a third transistor of the primary conductive type which operates based on a first signal from the first differential amplifier; and~~

~~—— a third transistor of the secondary conductive type connected in series to the third transistor of the primary conductive type and operating based on a second signal from the second differential amplifier circuit;~~

~~—— wherein a voltage between the third transistor of the primary conductive type and the third transistor of the secondary conductive type is an output voltage.~~